Pump
frequency
f^p

f_{in}

Optical gate

$f_{out} = f^p$

Figure 1

Pump
frequency
f^p

f_{in}

Wave Mixer

$f_{out} = f^p - f_{in}$

Difference-frequency generation

Figure 2
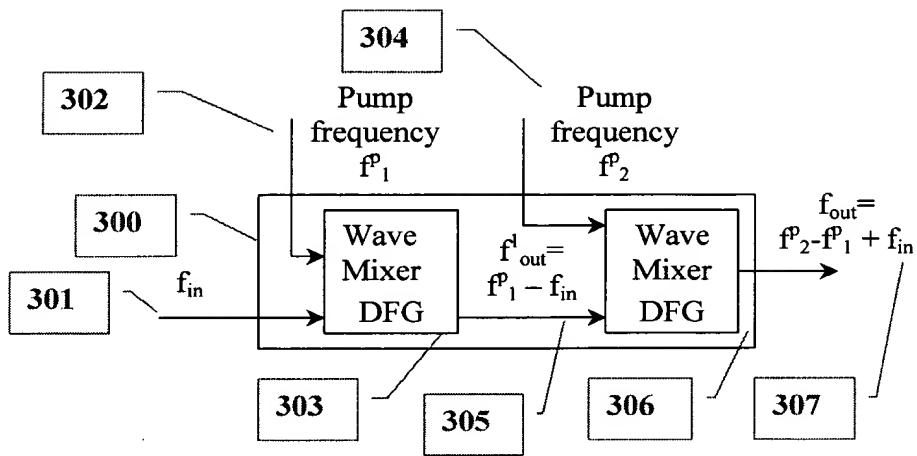
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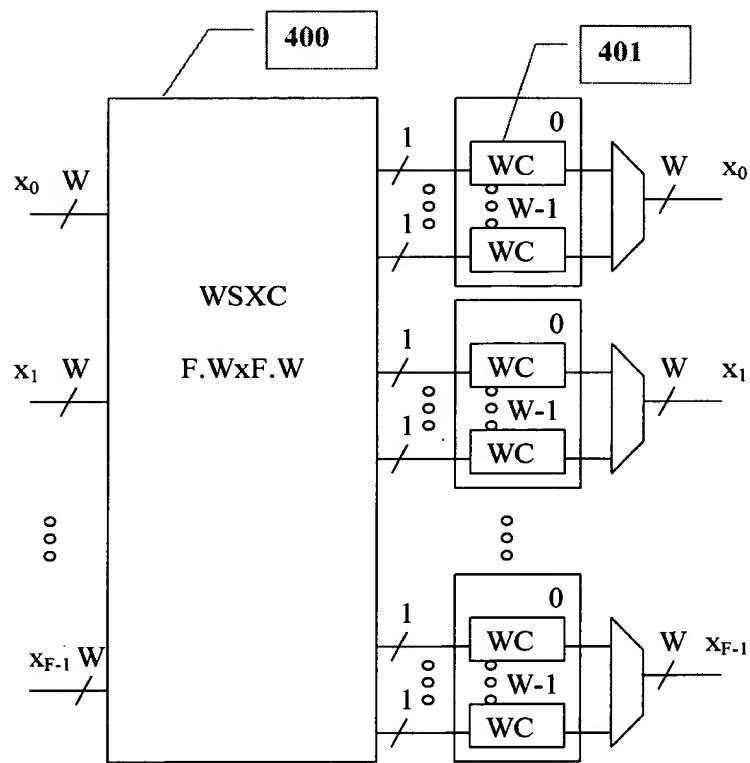
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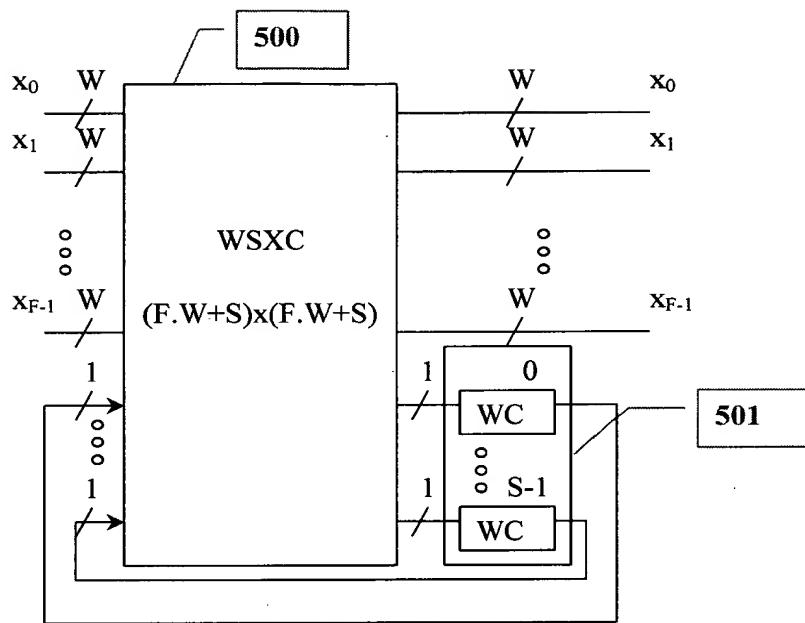
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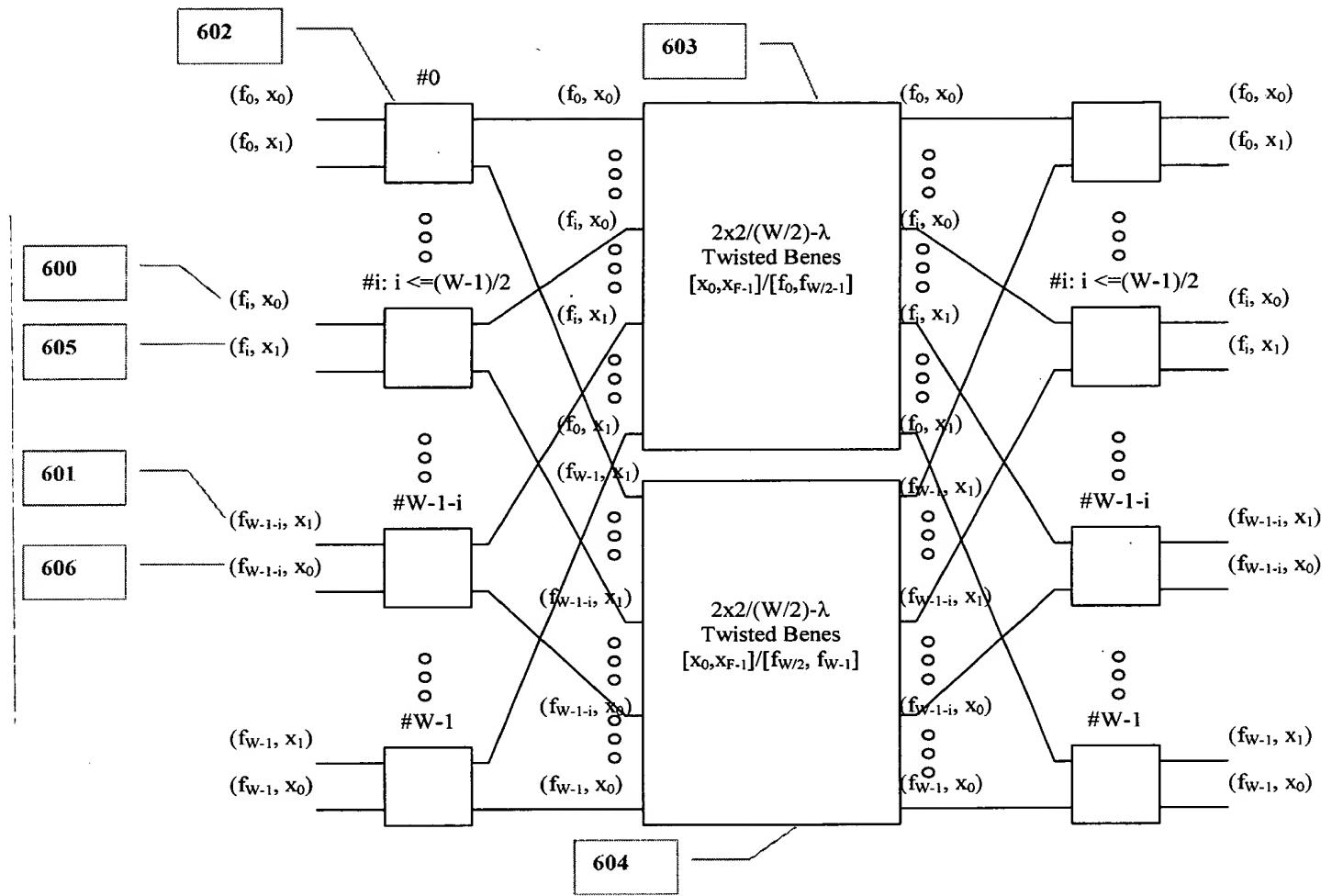
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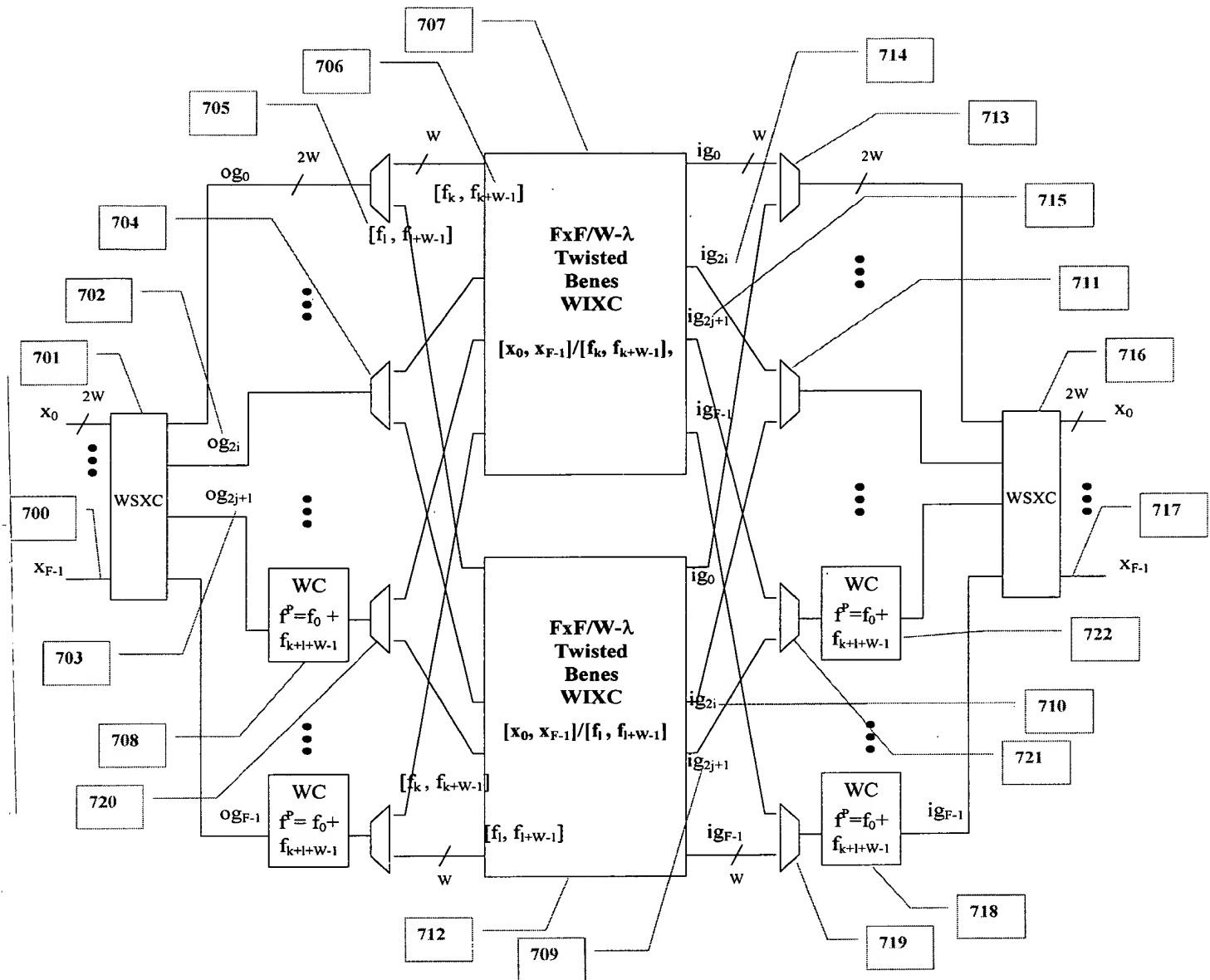
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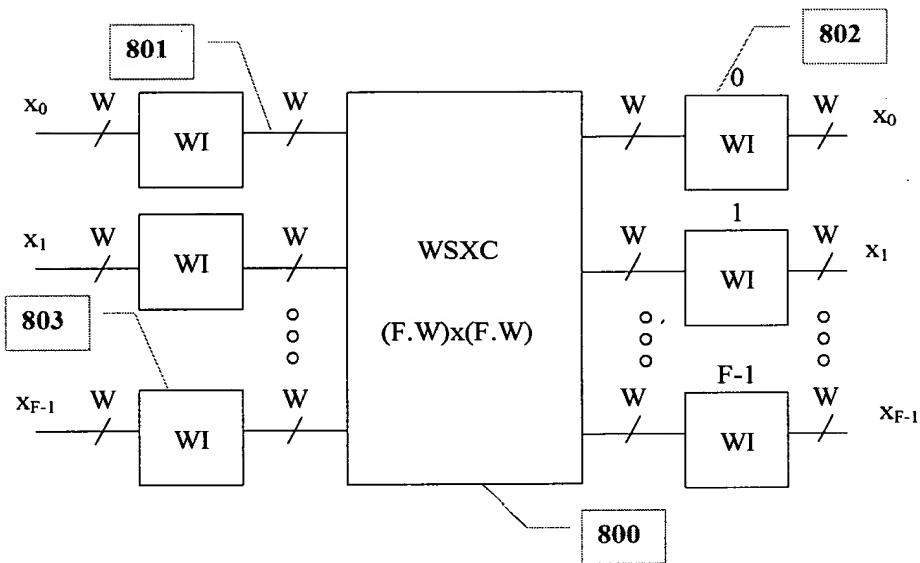
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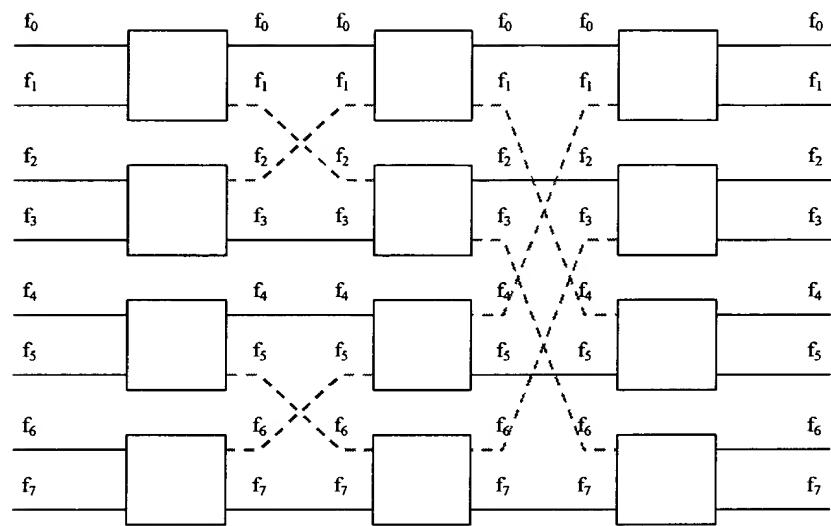
Figure 9

Log$_2$(8,1,1) network

Original self-routing network   One horizontal extension

Log$_2$(8,2,1) network

Original self-routing network   Two horizontal extensions
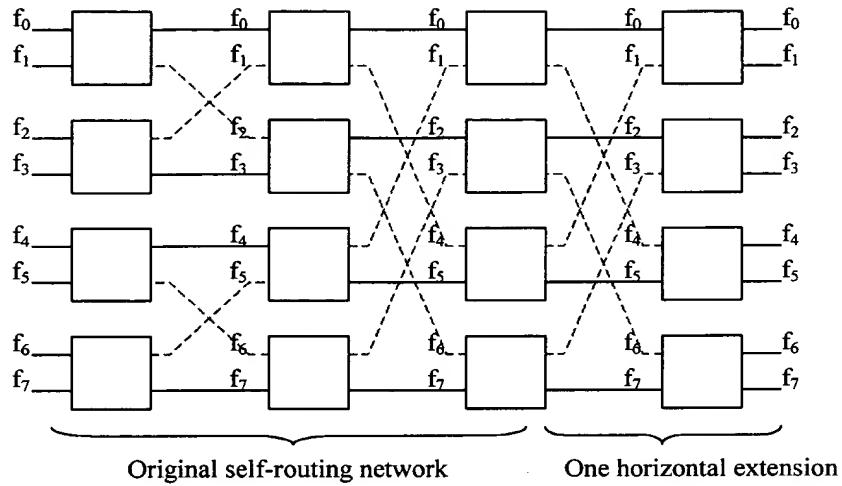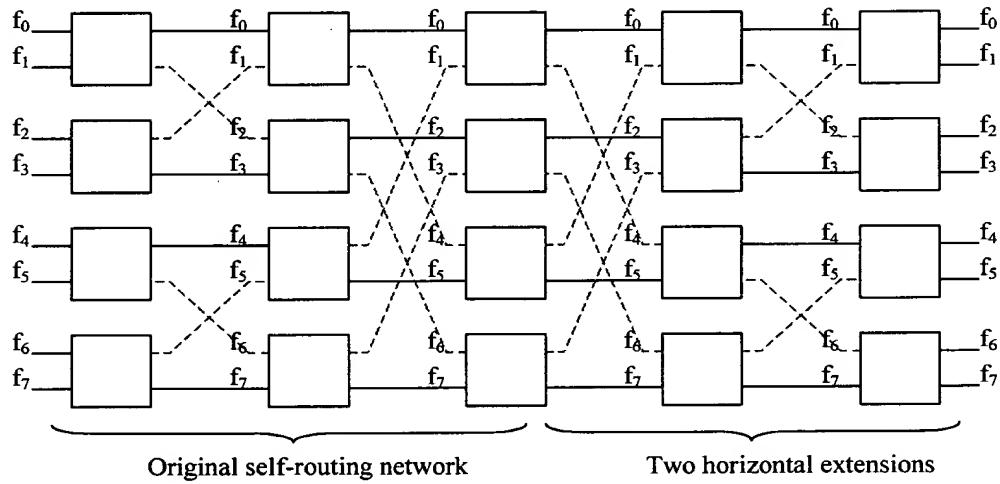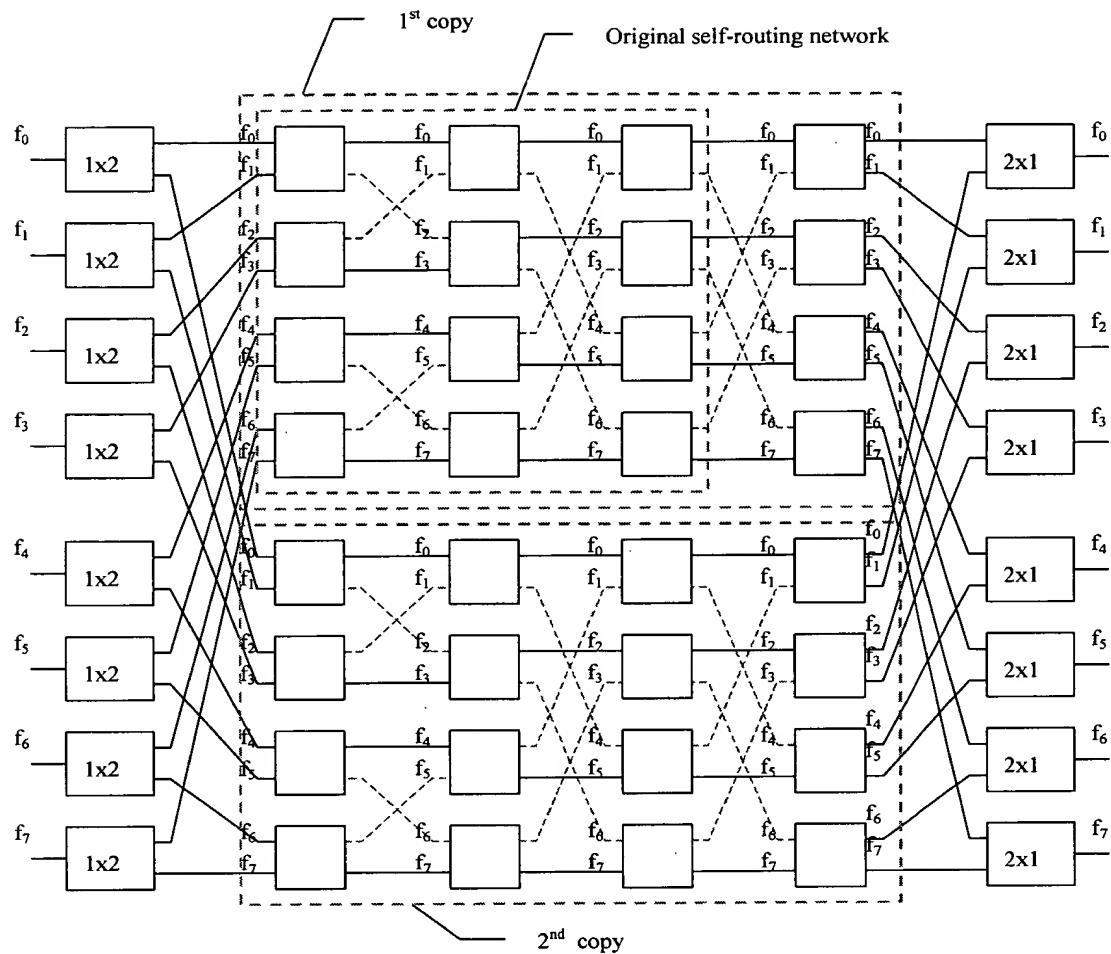
Figure 10

Figure 11

Figure 12

Figure 13

f_i
signal i f_i
                                  signal i

┌──────┐
│ SE │
└──────┘

f_{i+1} f_{i+1}
signal i+1   signal i+1

Bar state

f_i f_i
signal i   signal i+1

┌──────┐
│ SE │
└──────┘

f_{i+1} f_{i+1}
signal i+1   signal i

Cross state
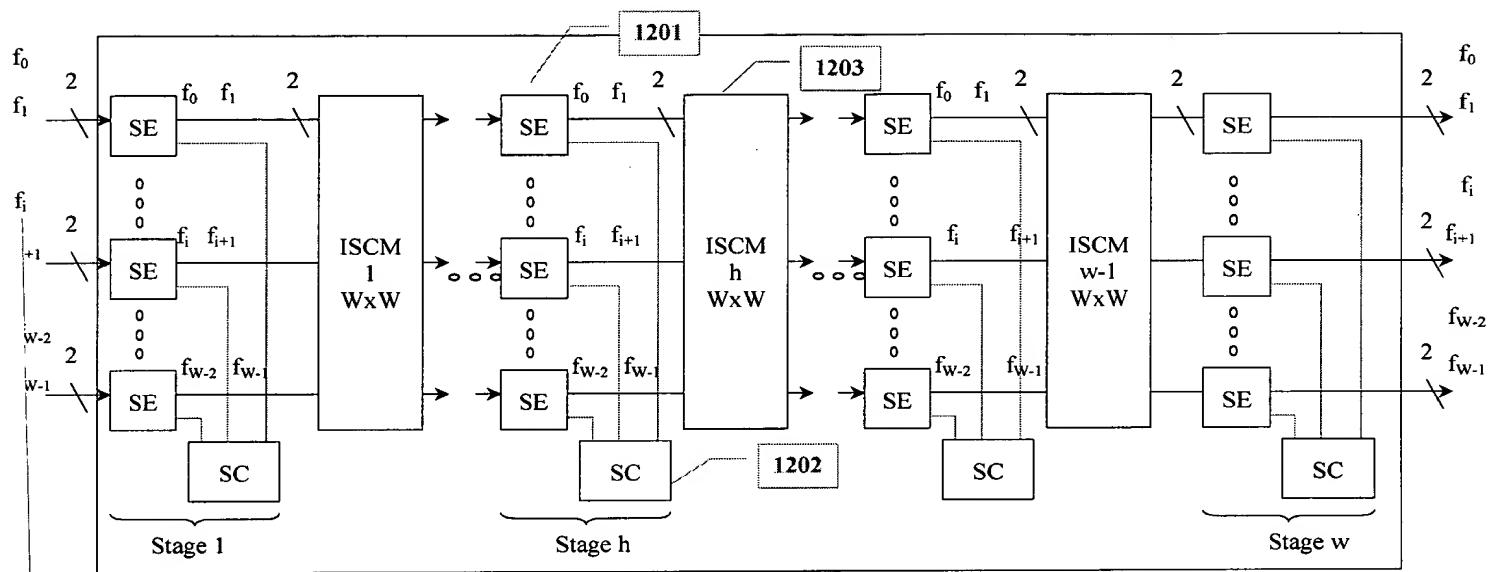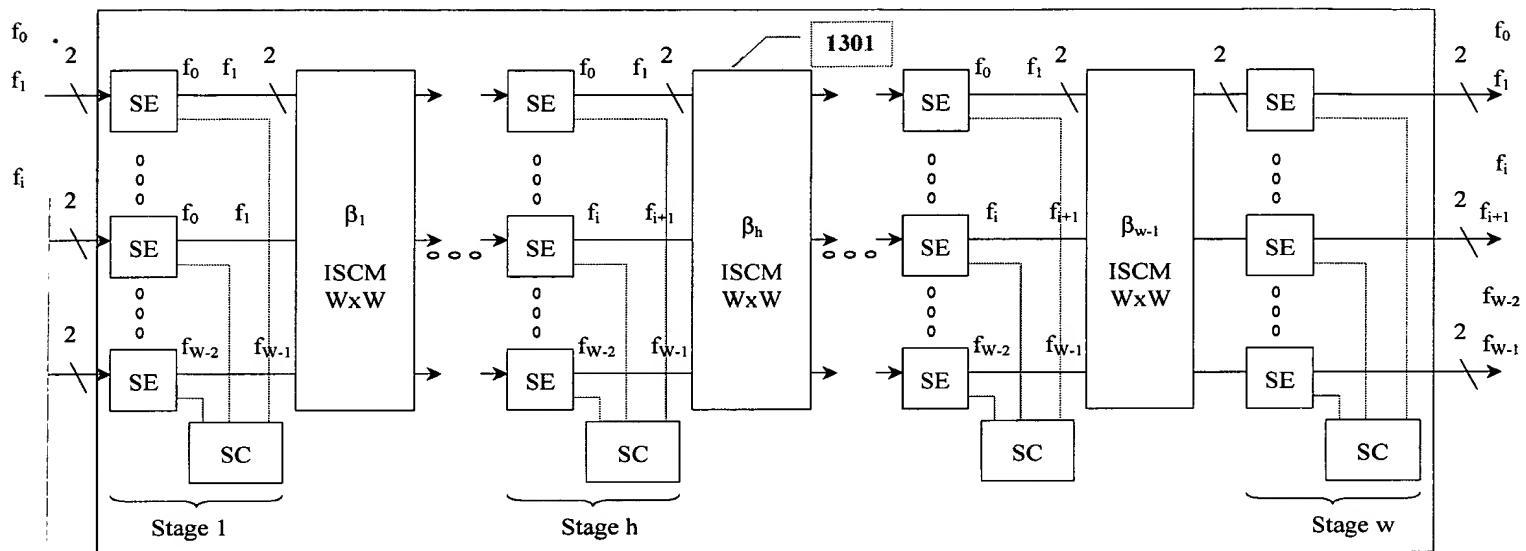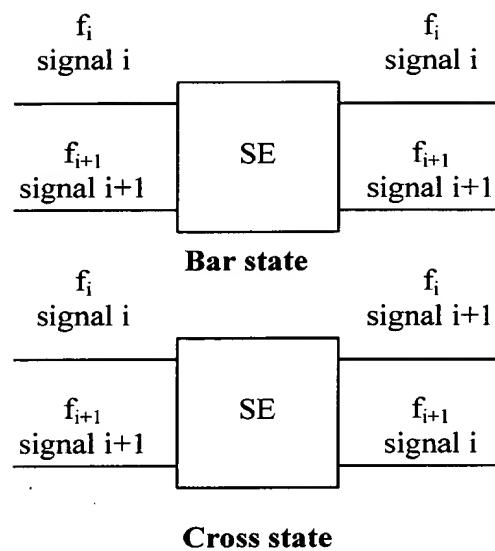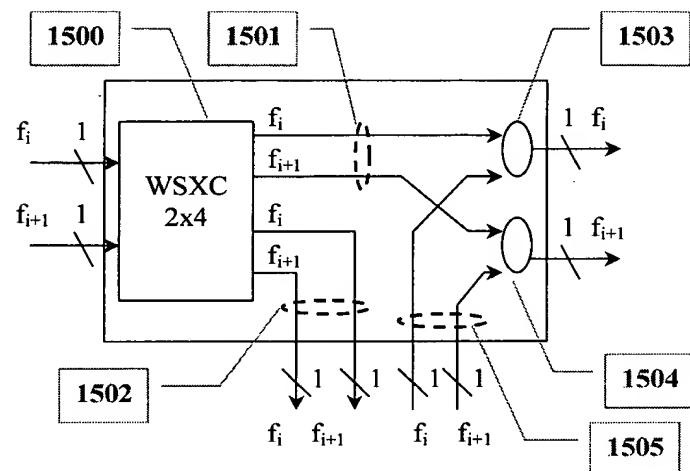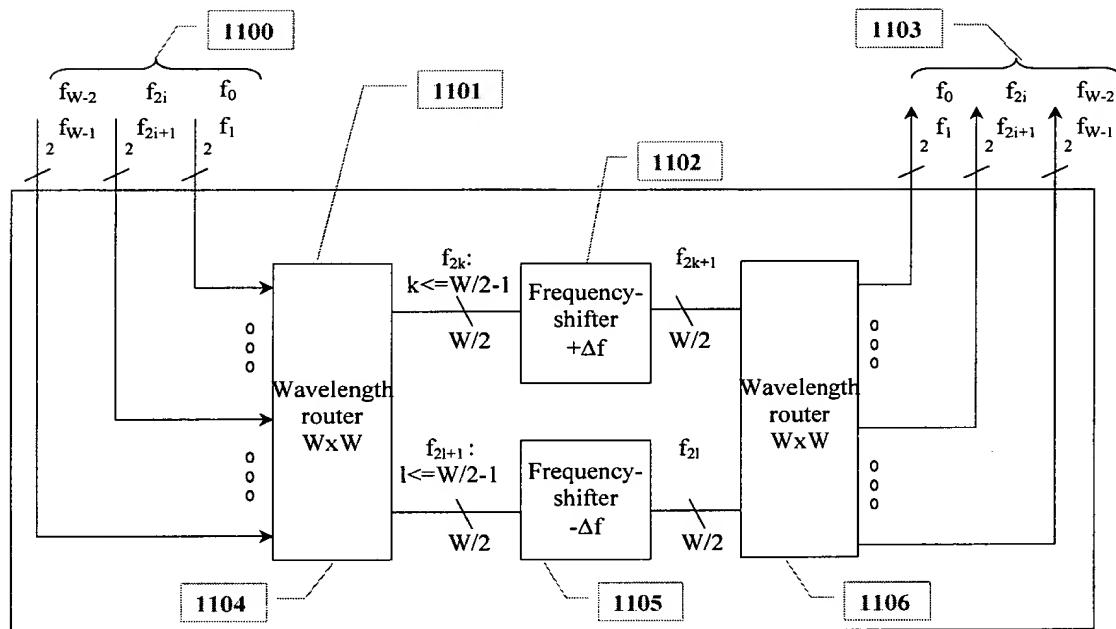
Figure 14

Figure 15

Figure 16
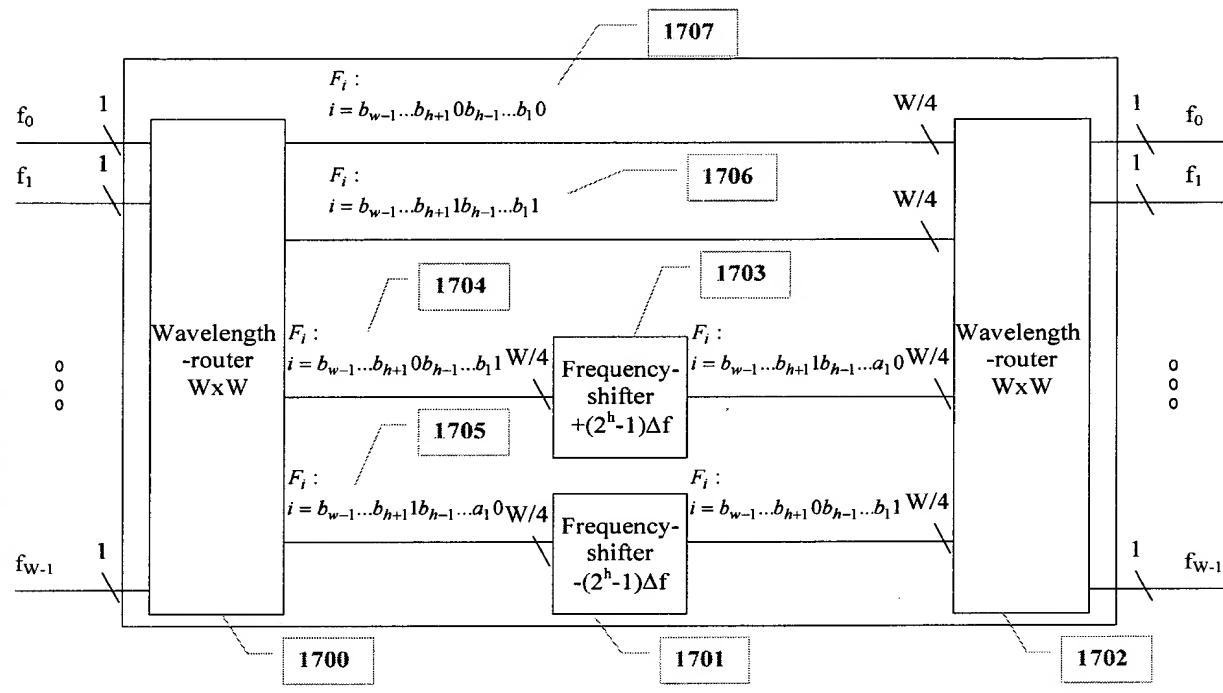
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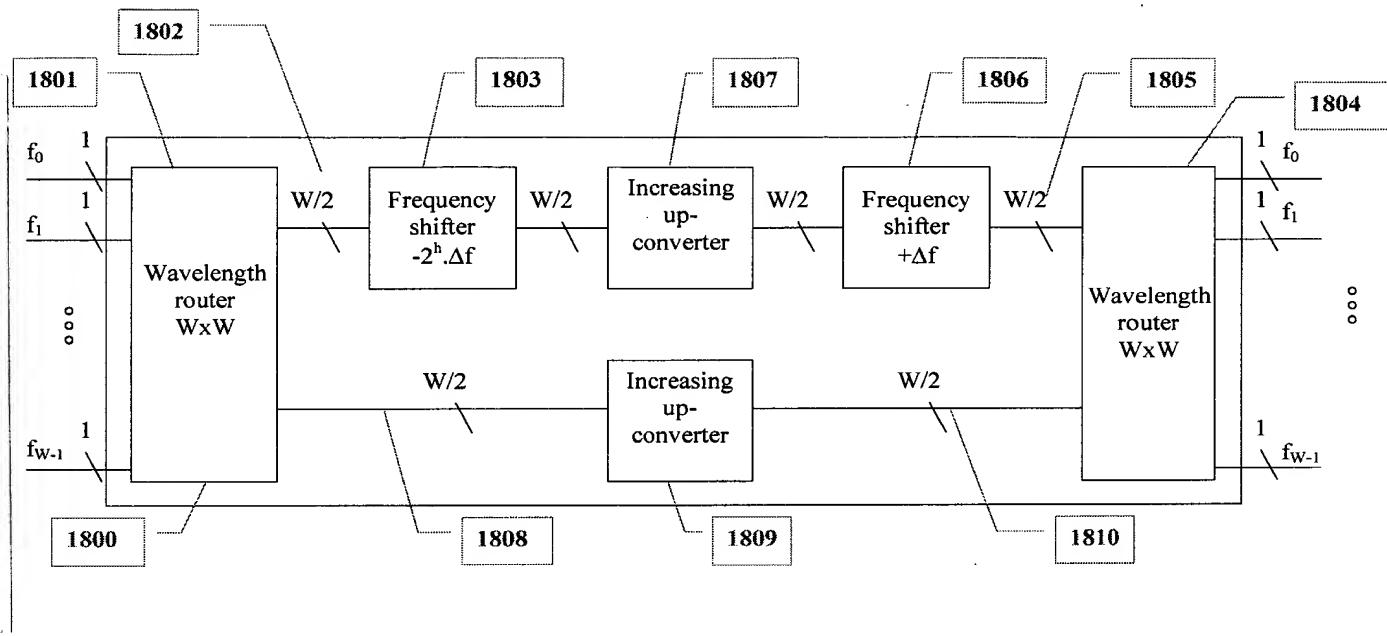
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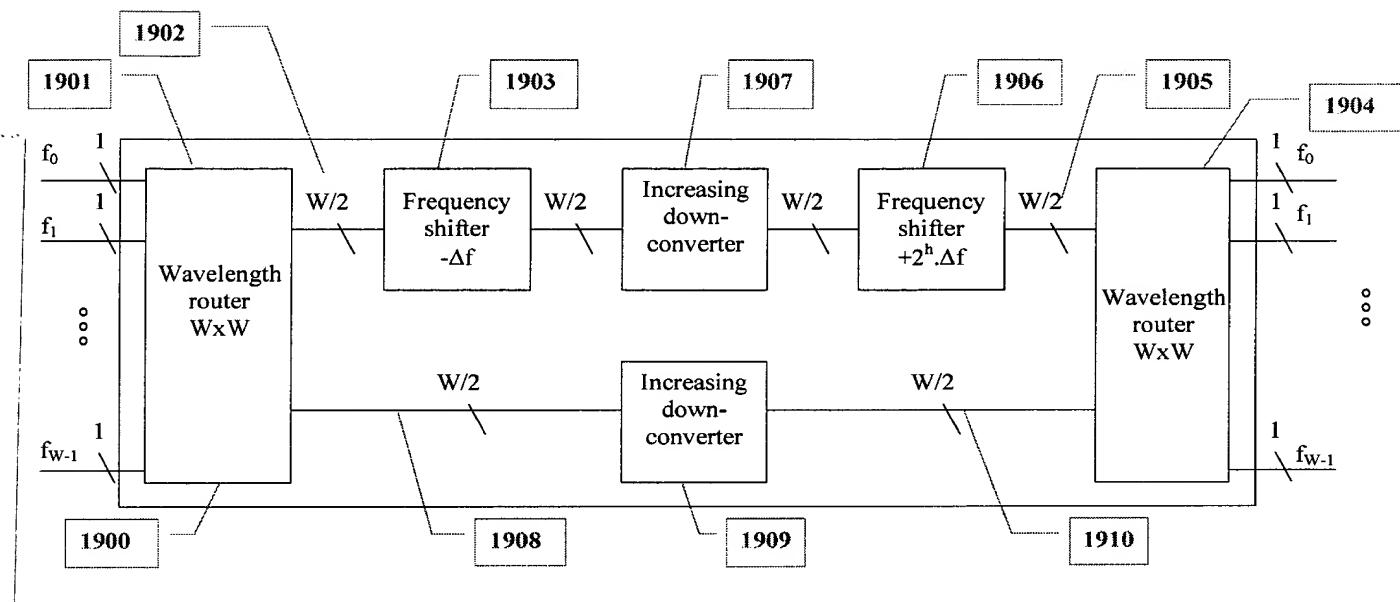
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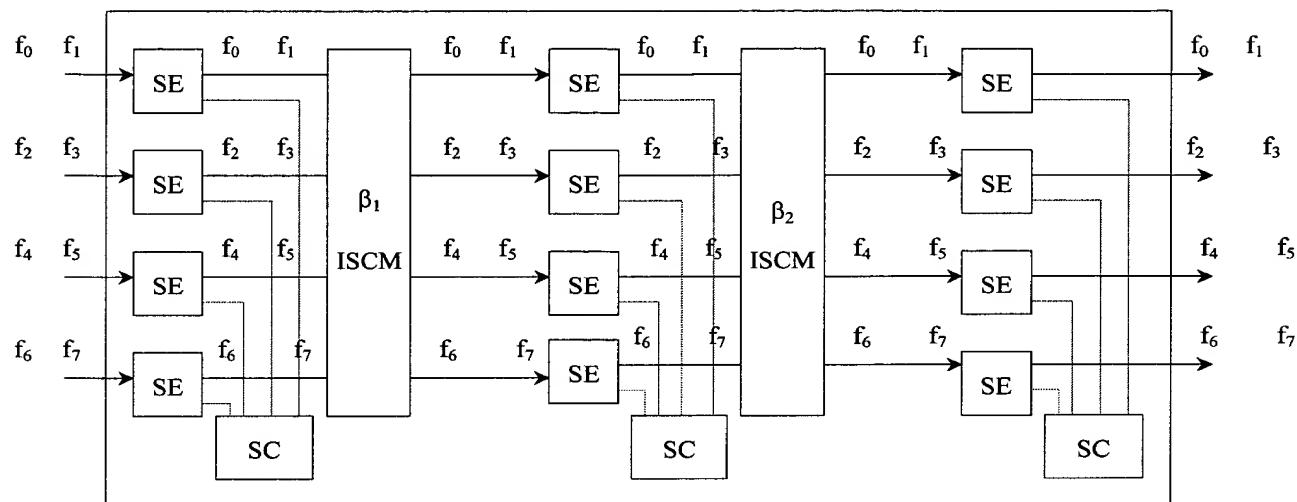
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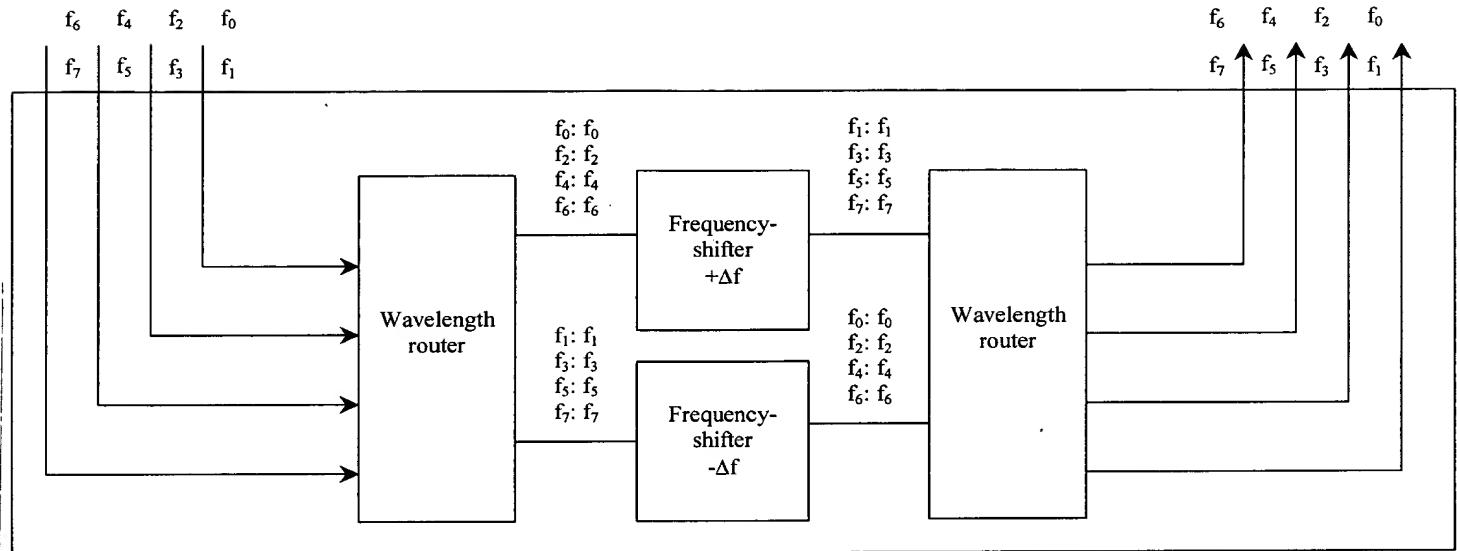
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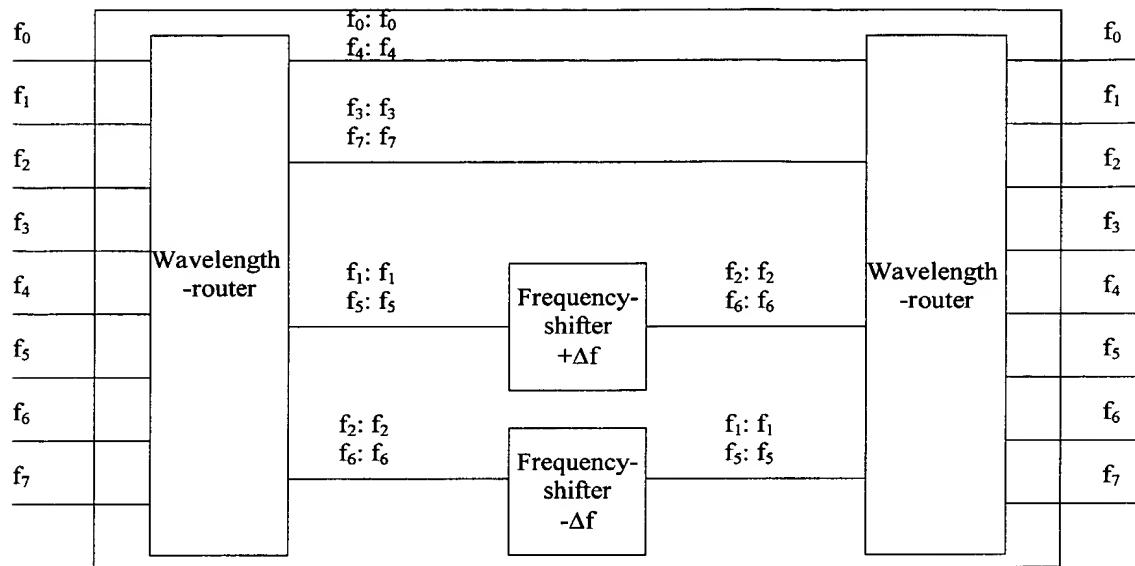
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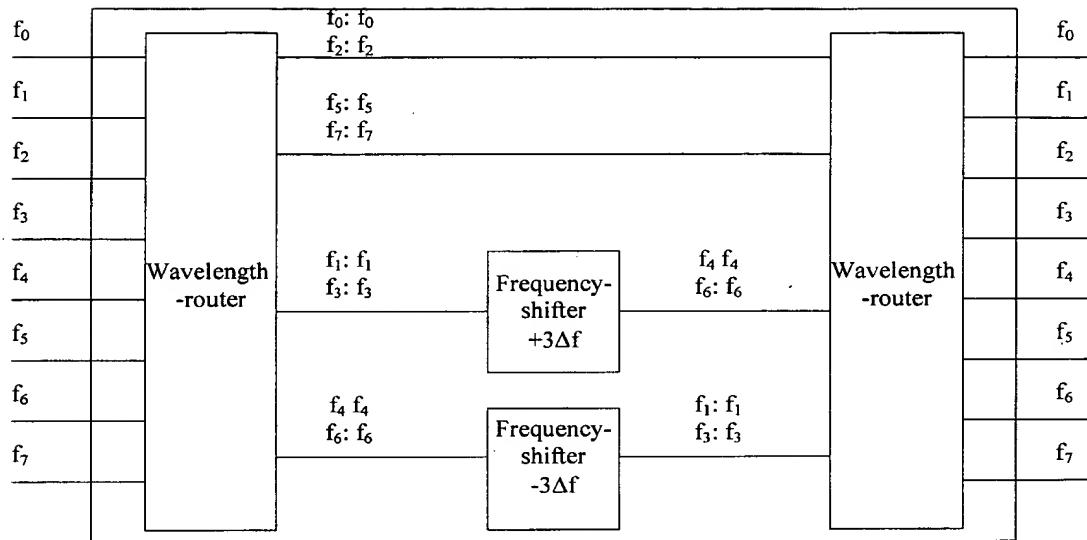
Figure 23
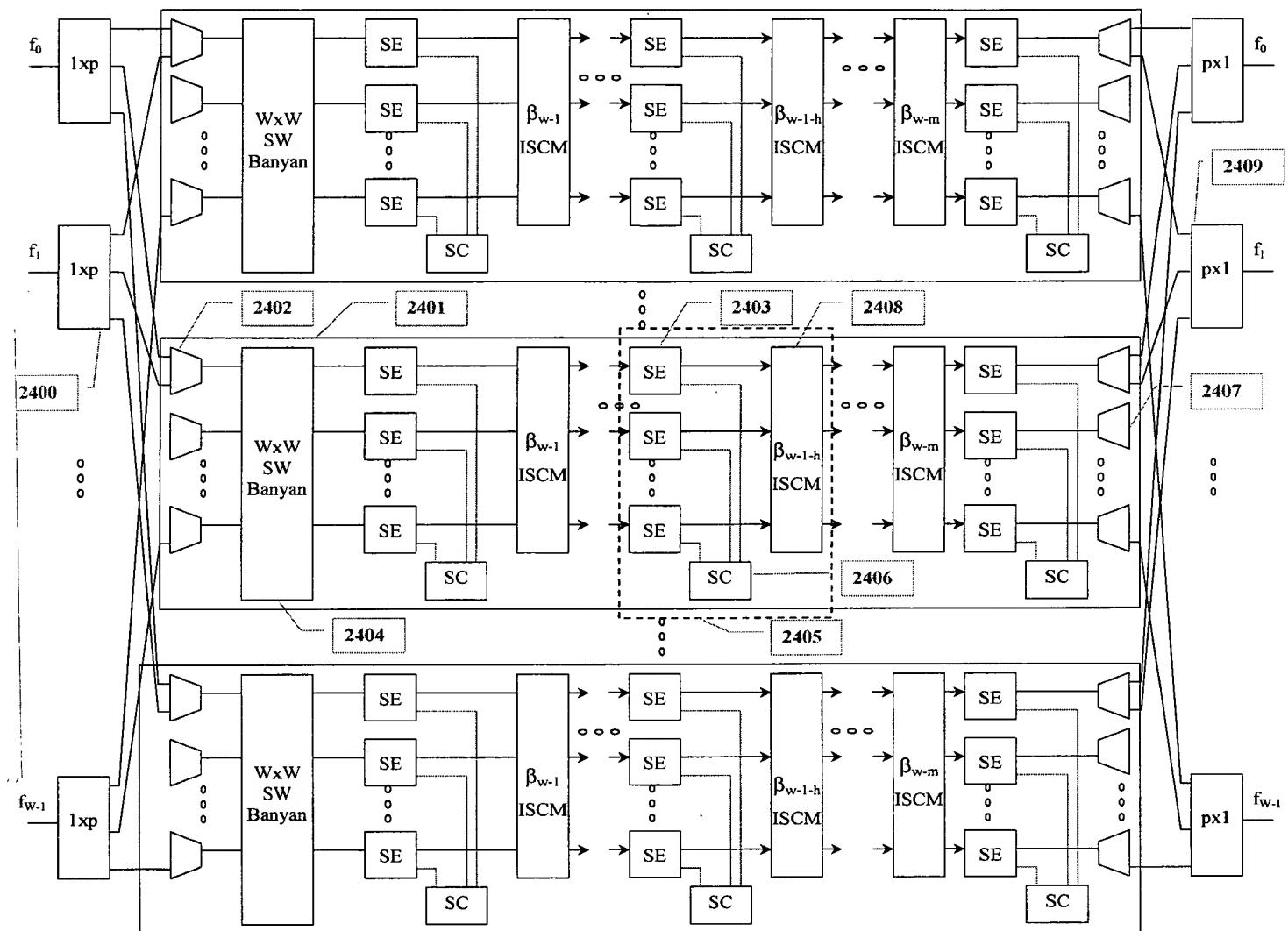
Figure 24

	P(0)	P(h) $0<h<n$	P(n)
Omega	σ_{n-1}	σ_{n-1}	J
Omega^{-1}	J	σ_{n-1}^{-1}	σ_{n-1}^{-1}
SW-Banyan	J	β_h	J
SW-Banyan^{-1}	J	β_{n-h}	J
n-cube	σ_{n-1}	β_{n-h}	J
n-cube^{-1}	J	β_h	σ_{n-1}^{-1}
Baseline	J	σ_{n-h}^{-1}	J
Baseline^{-1}	J	σ_h	J

Figure 25

Component	Number	Frequency-shifters
State changer	$\log_2(W)$	2
Butterfly ISCM	$\log_2(W)-1$	2

Figure 26

Self-routing network	Number of frequency-shifters
SW-Banyan	$O(\log_2 W)$
Baseline	$O\big((\log_2 W)^2\big)$
n-cube	$O(\log_2 W)$
Omega	$O\big((\log_2 W)^2\big)$

Figure 27

Networks	Near-optimal parameter choice	Wavelength-interchanger frequency-shifter complexity	Overall separable cross-connect frequency-shifter complexity
Near-optimal rearrangeably nonblocking	$m = w - 1$ $p = 1$	$4w - 4$	$4.F.(w-1)$
Near-optimal strictly-nonblocking	$m = w - 1$ $p = w$	$4.w^2 - 4.w$	$4.F.w.(w-1)$

Figure 28